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Crispin

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(54) **RIFLESCOPE ADJUSTMENT KNOB WITH INTERCHANGEABLE ADJUSTMENT INDICATOR RING**

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F41G 1/38 (2006.01)
G05G 1/10 (2006.01)

(52) **U.S. Cl.**
CPC ... ***G05G 1/10*** (2013.01); ***F41G 1/38*** (2013.01)

(58) **Field of Classification Search**
USPC 42/119, 122, 135, 136, 137; 359/399, 359/429; 74/553
See application file for complete search history.

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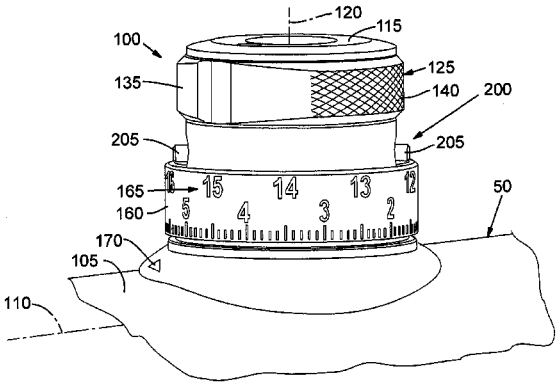
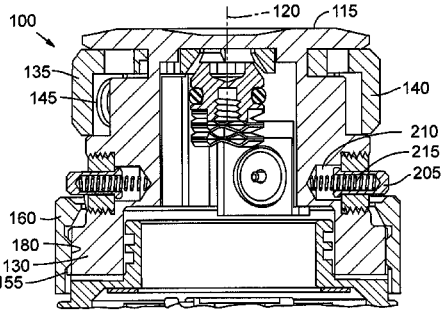
(57) **ABSTRACT**

An adjustment device having a rotatable knob for changing an adjustable setting of an aiming device, such as a riflescope. The knob includes a removable indicator ring slidable onto the knob and bearing a scale to provide visual feedback to a shooter regarding an adjustment position of the adjustable setting. The knob further carries a releasable latch that may extend radially outward relative to the knob to retain the indicator ring on the knob when the latch is in the latched position. When the shooter desires to remove and replace the indicator ring, such as in response to a change in shooting conditions, the latch may be released to an unlatched position to allow the indicator ring to be moved off of the knob. The shooter may thereafter insert a replacement indicator ring on the knob.

16 Claims, 4 Drawing Sheets





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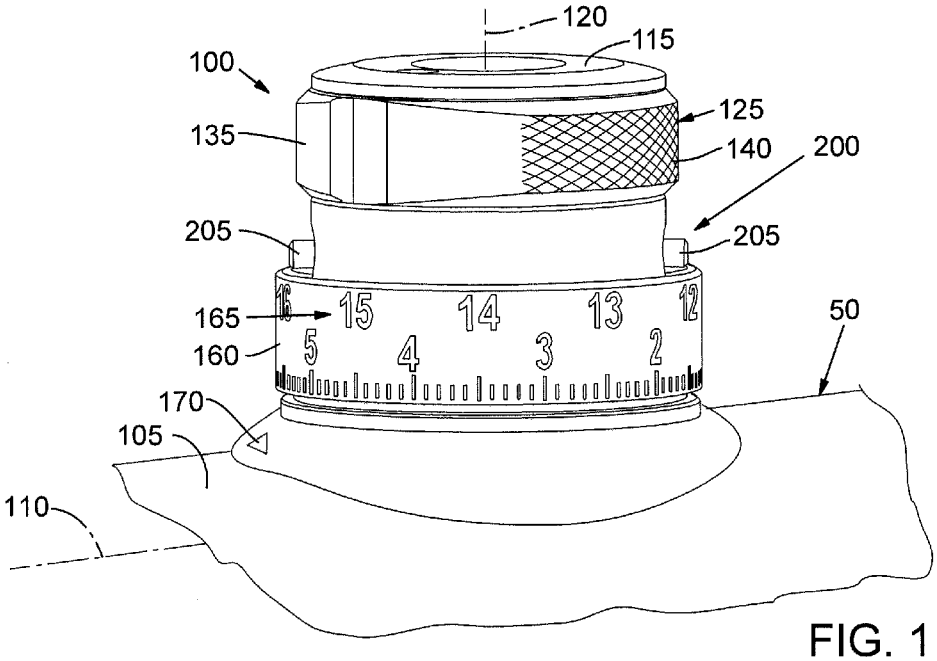
120
115
100
125
135
140
200
205
205
165
160
16
15
14
13
12
5
4
3
2
50
170
105
110

FIG. 1

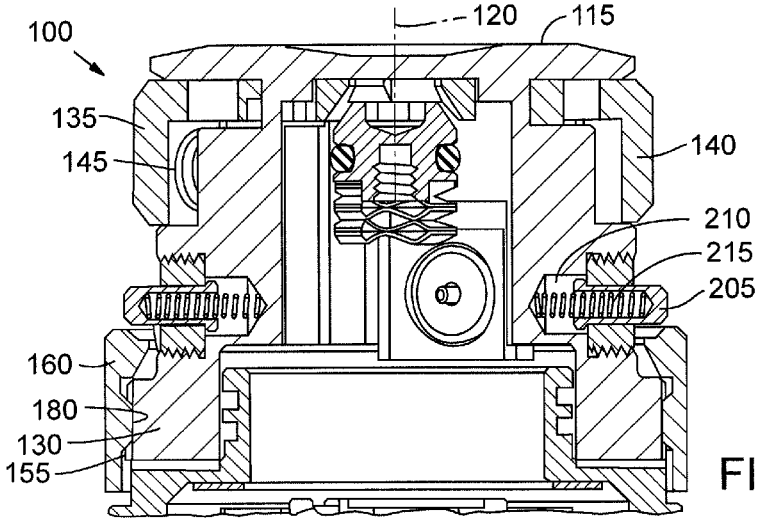
120
115
100
135
145
140
210
215
205
160
180
130
155

FIG. 2

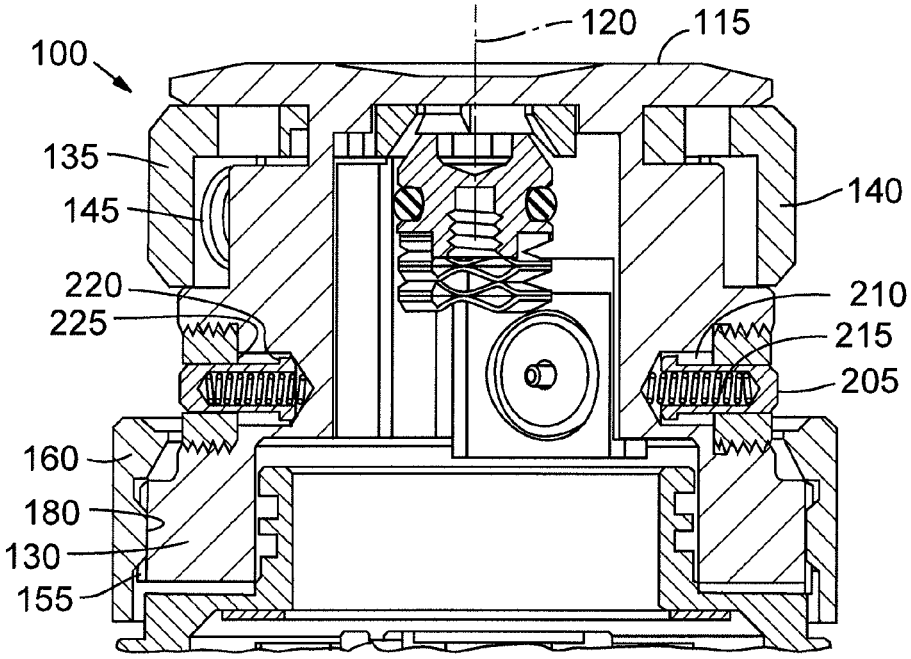
120
115
100
135
145
140
220
225
210
215
205
160
180
130
155

FIG. 3

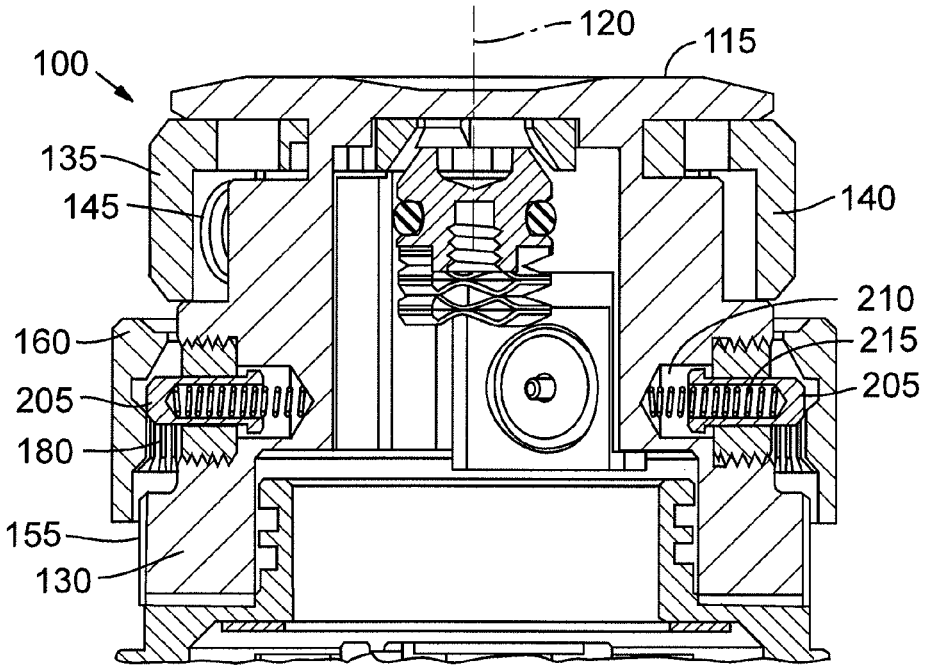
120
115
100
135
145
140
210
215
205
160
205
180
155
130

FIG. 4

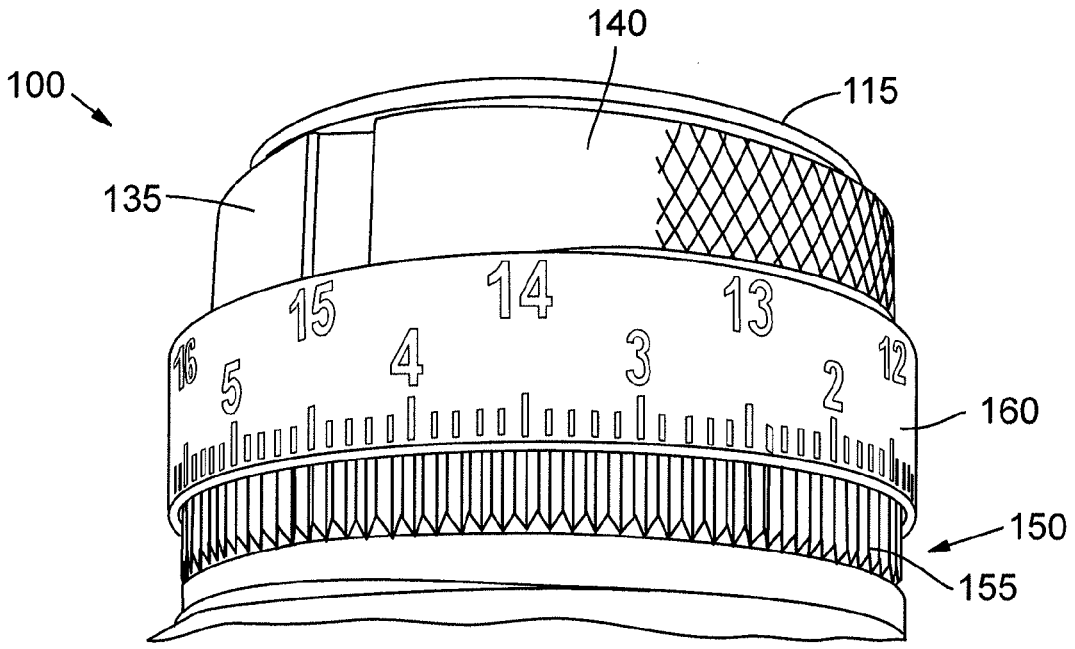

FIG. 5

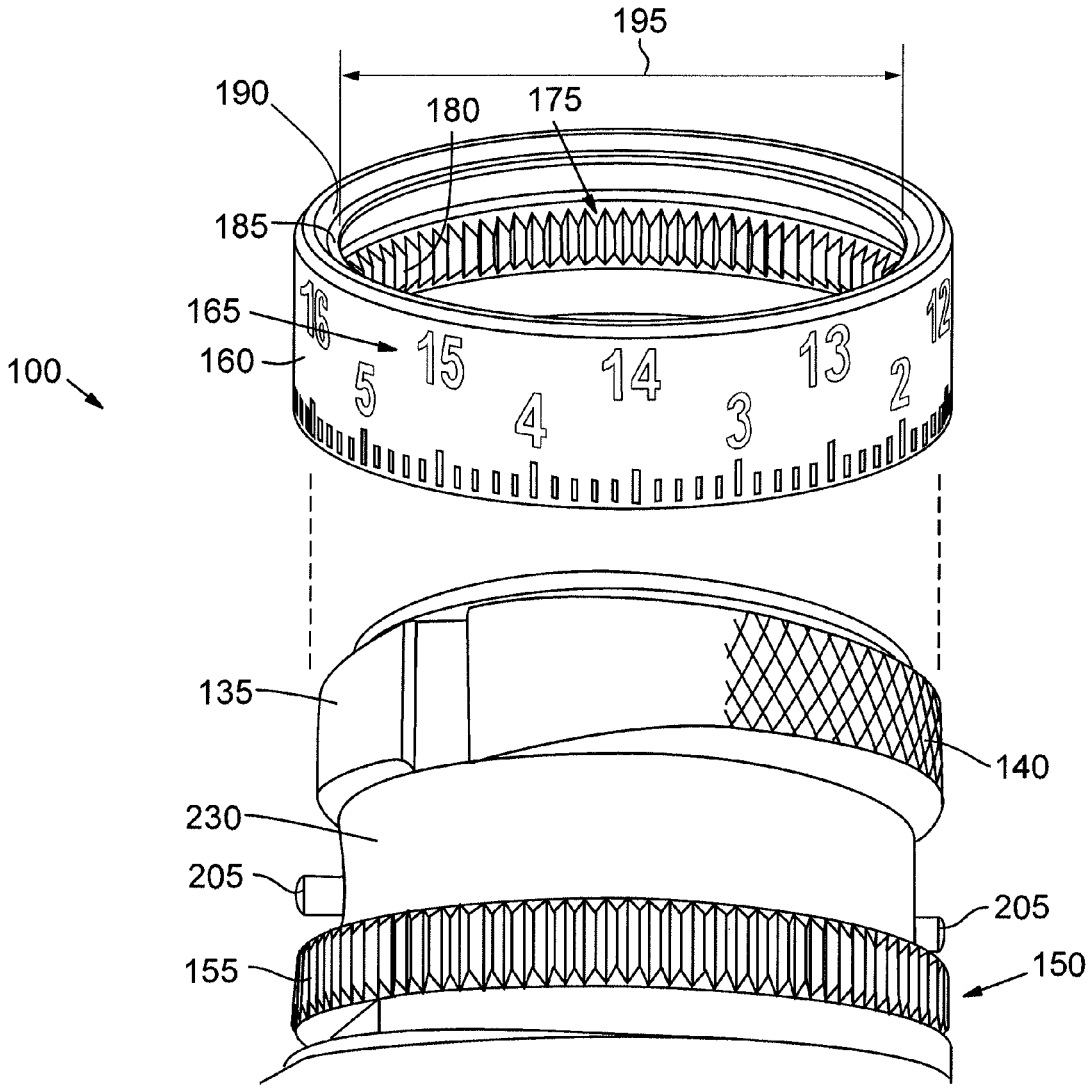
195
190
180
175
185
165
160
100
16
15
14
13
12
5
4
3
2
135
140
230
205
205
155
150

FIG. 6

RIFLESCOPE ADJUSTMENT KNOB WITH INTERCHANGEABLE ADJUSTMENT INDICATOR RING

RELATED APPLICATIONS DATA

This application is a continuation of U.S. patent application Ser. No. 13/683,985, filed Nov. 21, 2012, and titled "Riflescope Adjustment Knob With Interchangeable Adjustment Indicator Ring," the disclosure of which is incorporated herein by reference.

TECHNICAL FIELD

The field of the present disclosure relates generally to rotating adjustment knobs for a sighting device, such as a riflescope, a telescope, or other aimed optical device, and in particular, to such knobs configured to allow a shooter to quickly exchange an indicator ring bearing a scale in response to changed shooting conditions.

BACKGROUND

Sighting devices such as riflescopes have long been used in conjunction with weapons and firearms, such as rifles, handguns, and crossbows, to allow a shooter to accurately aim at a selected target. Because bullet and arrow trajectory, wind conditions, and distance to the target can vary depending upon shooting conditions, quality sighting devices typically provide compensation for variations in these conditions by allowing a shooter to make incremental adjustments to the optical characteristics or the aiming of the sighting device relative to the weapon surface on which it is mounted. These adjustments are known as elevation and windage adjustments, and are typically accomplished by lateral movement of an adjusting member, such as a reticle located within the riflescope, as shown in U.S. Pat. No. 3,058,391 of Leupold, or movement of one or more lenses within a housing of the riflescope, as shown in U.S. Pat. Nos. 3,297,389 and 4,408,842 of Gibson, and U.S. Pat. No. 7,827,723 of Zaderey et al.

The shooter typically makes such adjustments using rotatable adjustment knobs to actuate the adjustable member of the sighting device. In some riflescopes, an index mark on the housing of the riflescope provides a reference by which a shooter may read a scale marked around the circumference of the adjustment knob. These scales typically are finely tuned for specific weapons, weapon types, ammunition characteristics, distances, atmospheric conditions, and a host of other variables. Accordingly, scales tuned for one set of conditions may be inaccurate when used with different ammunition, weapons, geographic elevation, and/or temperature for which the scale was calibrated. Thus, when a shooter faces changes in shooting conditions, the shooter may desire to replace the scale with a suitable scale that is appropriately calibrated to provide the proper reference for the new shooting conditions.

In some systems, such as the assemblies described in U.S. Pat. No. 7,997,163 and U.S. Pat. Pub. No. 2008/0289239, the adjustment knob includes a scale etched, inscribed, or otherwise marked on a portion of the adjustment knob. In such assemblies, the shooter uses a tool to disengage a screw or a pin retaining the knob on the riflescope. The knob is thereafter removed and replaced with a different knob having a properly calibrated scale intended to be used for the new shooting conditions.

Other systems, such as the assembly described in U.S. Pat. No. 8,001,714, use ballistics calculations and other calibration data in conjunction with a label making apparatus to generate a printed label with dial-calibration data customized to different types of projectiles and different shooting conditions. A number of individual labels may be generated with calibration data for different projectiles, shooting conditions, etc. Thereafter, each label may be taped or otherwise affixed around a turret to create a number of customized turrets suitable for different types of projectiles and/or shooting conditions. In a similar system using labels bearing calibration data, such as the system described in U.S. Pat. No. 4,285,137, the labels may simply be removed and replaced on the knob as needed.

The present inventor has recognized a number of disadvantages associated with such riflescope configurations. One disadvantage is that a shooter will have to purchase and carry various knobs for a number of different shooting conditions. In addition, replacing the knob typically requires the shooter to carry and use tools, such as a hex key, to remove and refasten set screws or other fasteners that mount the knob to the riflescope housing, and there is a risk of dropping or losing components during the replacement process.

The present inventor has, thus, recognized a need for an improved knob assembly with an easily exchangeable scale for quickly adjusting to changes in shooting conditions without requiring the use of tools or removing the knob assembly from the riflescope housing to effectuate such exchanges.

Additional aspects and advantages will be apparent from the following detailed description of preferred embodiments, which proceeds with reference to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a side elevation view of an adjustment knob bearing an indicator ring, and illustrating a latch in a latched position to retain the indicator ring on the adjustment knob;

FIG. **2** is a cross-sectional view of the adjustment knob of FIG. **1** taken through a center line of the latch;

FIG. **3** is a cross-sectional view of the adjustment knob of FIG. **1** illustrating the latch in an unlatched position;

FIG. **4** is a cross-sectional view of the adjustment knob of FIG. **1** with the indicator ring in a partially released condition;

FIG. **5** is a side elevation view of the adjustment knob of FIG. **4**;

FIG. **6** is a side elevation view of the adjustment knob of FIG. **1** with the indicator ring fully removed.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

With reference to the drawings, this section describes particular embodiments and their detailed construction and operation. Throughout the specification, reference to "one embodiment," "an embodiment," or "some embodiments" means that a particular described feature, structure, or characteristic may be included in at least one embodiment. Thus appearances of the phrases "in one embodiment," "in an embodiment," or "in some embodiments" in various places throughout this specification are not necessarily all referring to the same embodiment. Furthermore, the described features, structures, and characteristics may be combined in any suitable manner in one or more embodiments. In view of the disclosure herein, those skilled in the art will recognize that the various embodiments can be practiced without one or more of the specific details or with other methods, components, materials, or the like. In some instances, well-known

structures, materials, or operations are not shown or not described in detail to avoid obscuring aspects of the embodiments.

FIGS. **1-6** illustrate various detailed views of an adjustment device **100** that may be used to change an adjustable setting of a riflescope **50** or other aiming device, and that includes an indicator ring **160** bearing a scale **165** to provide a reference point to the shooter regarding an adjustment position of the device **100** and the adjustable setting of riflescope **50**. Adjustment device **100** is configured for easily exchanging indicator ring **160** to allow the shooter to quickly respond to variations in shooting conditions.

With particular reference to FIGS. **1-3**, adjustment device **100** includes a knob **115**, where adjustments may be made by rotation of knob **115** about a rotational axis **120**. Knob **115** carries a manually actuatable latch **200** configured to move between a latched and unlatched position. When in a latched position, latch **200** retains indicator ring **160** against a lower base portion **130** of knob **115** and substantially inhibits sliding or other movement of indicator ring **160** along axis **120** (i.e., movement in an upward direction away from knob **115**). Latch **200** will be in a latched position when knob **115** is turned to adjust settings of riflescope **50**. When replacement of indicator ring **160** is required, such as to accommodate a changed shooting condition (e.g., change in elevation and/or temperature), latch **200** may be manually actuated to an unlatched position, whereby indicator ring **160** is free to slide along axis **120** and away from lower base portion **130** of knob **115** (see FIGS. **4-6**). Once indicator ring **160** has been removed, a different replacement indicator ring (not shown) may be fitted onto knob **115** by sliding the replacement ring past latch **200** and onto lower base portion **130** of knob **115**.

The following describes further detailed aspects of this and other embodiments of the adjustment device **100**. In the following description of the figures and any example embodiments, reference may be made to using the adjustment device disclosed herein to actuate an adjustable member of a sighting device on a weapon or firearm, such as for making elevation and windage adjustments. It should be understood that any such references merely refer to one prospective use for such an adjustment device and should not be considered as limiting. Other uses for such adjustment devices with the characteristics and features described herein are possible, including use in other mechanical or electrical devices for making adjustments. In addition, although the following description is made with reference to a single adjustment device, the riflescope or other device may include multiple such adjustment devices.

In the following detailed description, the structure and function of some interior components of adjustment device **100**, such as a spindle, plunger, retaining rings, and other components, are not described in detail herein to avoid obscuring pertinent aspects of the embodiments described herein. It should be understood that such components of the adjustment device **100** may be arranged in a variety of configurations. For instance, in some embodiments, the internal mechanism of adjustment device **100** may be configured as described in U.S. Pub. No. 2011/0100152, U.S. Pat. No. 6,279,259, 6,351,907, 6,519,890, or 6,691,447, the disclosures of which are incorporated by reference herein. In other embodiments, the adjustment device may have different mechanical arrangements and accompanying structures for effecting a mechanical, electrical, and/or optical adjustment.

With particular reference to FIGS. **1-2**, adjustment device **100** is mounted to a main tube **105** of riflescope **50**. Within main tube **105**, at least one adjustable element, such as a reticle, lens assembly, or other optical or electrical elements, may be movably mounted in a substantially perpendicular orientation relative to a longitudinal tube axis **110**. Rotation of knob **115** about rotational axis **120** actuates these adjustable elements to adjust a desired characteristic of the sighting device.

Knob **115** includes a gripping surface **125** and a lower base portion **130**. Gripping surface **125** may partially or entirely encircle knob **115** and may be notched, fluted, knurled, or otherwise textured to provide a surface for the user to grip when manually rotating knob **115**. In some embodiments, gripping surface **125** may include a pair of manually actuatable buttons **135**, **140** spaced apart from each other and positioned on opposite sides of gripping surface **125**, the buttons **135**, **140** being spring-biased to automatically lock knob **115** to prevent inadvertent rotation of knob **115** as described in U.S. Pub. No. 2011/0100152. In an example operation, knob **115** may be unlocked by squeezing or radially pinching buttons **135**, **140**, such as between a user's thumb and forefinger, to move buttons **135**, **140** inwardly toward rotational axis **120** and against the bias of a spring **145**. Such inward movement of buttons **135**, **140** dislodges a locking pin (not shown) to allow rotation of knob **115** about axis **120**. When buttons **135**, **140** are released, spring **145** urges buttons **135**, **140** to move in a radially outward direction and the locking pin returns back to a locked position, thereby preventing further rotation of knob **115**. Further details of the locking pin and accompanying structures of such an automatic locking device are described in U.S. Pub. No. 2011/0100152.

Lower base portion **130** of knob **115** includes a receiving surface **150** with a number of uniformly incremented engagement features **155** spaced around its circumference (see FIG. **5**). In one embodiment, engagement features **155** may include splines or a series of evenly spaced vertical grooves or ridges. In other embodiments, engagement features **155** may include a series of detents, indentations, apertures, recesses, or other suitable features evenly spaced around receiving surface **150**. In still other embodiments, engagement features **155** may not be evenly spaced or may not extend around the entire circumference of receiving surface **150**.

In an assembled configuration, knob **115** further includes an indicator ring **160** slidable around knob **115** and encircling lower base portion **130**. Indicator ring **160** is marked with a scale **165** that allows the user to take a reading with respect to an index mark **170** located on riflescope **50**. In some embodiments, scale **165** may be marked around a portion or the entire circumference of indicator ring **160** and may include calibration markings corresponding to MOA intervals, distance intervals, or any other desired measurements. The markings may be divided into any number of major intervals, such as 1 MOA intervals, and minor intervals, such as ¼ MOA increments. In other embodiments, the markings may be divided and subdivided into any configuration and/or intervals as desired.

With particular reference to FIG. **6**, indicator ring **160** includes an engaging surface **175** having grooves, ridges, or other similar engagement features **180** keyed to mate with those on receiving surface **150** of knob **115**. In an assembled configuration, indicator ring **160** slips over and around knob **115** and slides downwardly along axis **120** to receiving surface **150**, where engagement features **155** on receiving surface **150** align with grooves **180** on engaging surface **175**. When so aligned, indicator ring **160** rotates about axis **120** with knob **115** when knob **115** is rotated, but is otherwise prevented from independently rotating about axis **120**.

In some embodiments, indicator ring **160** may include a lip or ridged section **185** extending from an inner surface **190** of indicator ring **160**. Lip section **185** is preferably an integral

structure of indicator ring **160** and extends partially or entirely around inner surface **190** to define an inner circumference **195**. In other embodiments, lip **185** may be a separate structure from indicator ring **160**, such as an annular ring that is adhered to or otherwise attached to inner surface **190** of indicator ring **160**. Further details and functional aspects of lip **185** are discussed below reference to latch **200**.

As mentioned previously, when shooting conditions change, a shooter may desire to replace the scale on the adjustment dial or knob with a different scale bearing a different set of markings to adjust the riflescope for new shooting conditions. The following describes one example embodiment of an adjustment device **100** configured for allowing a shooter to quickly and easily exchange such scale in response to changed shooting conditions.

In one embodiment, knob **115** includes a latch **200** configured to retain indicator ring **160** against knob **115** when latch **200** is in a latched position, and to allow free movement of indicator ring **160** away from or off of knob **115** when latch **200** is in an unlatched position. Latch **200** may comprise one of a variety of mechanisms configured to be moved between a latched position, where the latch **200** retains indicator ring **160** on knob **115**, and an unlatched position, where the latch **200** allows removal of indicator ring **160** off of knob **115**.

For instance, in one embodiment, latch **200** includes a pair of pins **205** each carried by knob **115** in an elongated bore **210**. A spring **215**, or other biasing element, exerts a force on pins **205** and urges pins **205** to extend radially outwardly from bore **210** such that pins **205** protrude outwardly from knob **115**. Pins **205** may include a necked region **220** that bears against an internal shoulder region **225** of knob **115** to retain pins **205** within bore **210** and counteract the force exerted by spring **215**. It should be understood that in other embodiments, latch **200** may include only one pin or may include more than two pins arranged in a similar fashion as described.

With particular reference to FIGS. **2-3**, latch **200** may be manually actuatable or depressible to transition from a latched position (as shown in FIG. **2**) to an unlatched position (as shown in FIG. **3**). In the latched position, springs **215** urge pins **205** outwardly from knob **115** to bear against lip **185** and thereby prevent upward movement of indicator ring **160** along axis **120**. In some embodiments, pins **205** may not directly bear against lip **185** in the latched position, but there may instead be a small clearance or gap between pins **205** and lip **185** such that indicator ring **160** may move slightly when pulled upwardly before pins **205** inhibit further movement. Preferably, pins **205** are positioned and dimensioned so as to maintain contact between engagement surfaces **150**, **175** of adjustment knob **115** and indicator ring **160**, respectively.

With particular reference to FIGS. **3-6**, to unlock latch **200**, pins **205** may be depressed inwardly or radially pinched (e.g., pinched between a thumb and forefinger) until they retract partially or entirely within bore **210**. Once pins **205** have been retracted, indicator ring **160** is free to slide upwardly along axis **120** and away from lower base portion **130** of knob **115** toward gripping surface **125** (as shown in FIG. **4**). In one example operation, a user may use one hand to pinch pins **205** inwardly and use the other hand to pull or slide indicator ring **160** upwardly. As indicator ring **160** approaches pins **205**, the user releases pins **205**, which may then automatically return to the latched position in response to the biasing force from springs **215**. Once released, pins **205** may or may not contact inner surface **190** (or lip **185**) of indicator ring **160**, but in any case, pins **205** will no longer further interfere or otherwise inhibit continued upward movement of indicator ring **160**.

Once indicator ring **160** has been removed, a replacement indicator ring may be installed on knob **115** by sliding it over knob **115** in a similar fashion as described previously. In particular, the replacement ring slides past gripping surface **125** and latch **200**, and engages receiving surface **150** on lower base portion **130** of knob **115**. Once the replacement indicator ring is positioned around lower base portion **130** and in engagement with receiving surface **150**, pins **205** retain the replacement indicator ring on knob **115**.

In another embodiment, the latch (e.g., latch **200**) may include one or more magnets configured for releasably retaining the indicator ring on the knob. In such embodiments, the attraction of the magnets retain the indicator ring on the knob. To remove the indicator ring, the shooter may pull the indicator ring upwardly along the rotational axis (e.g., axis **120**) with sufficient force to overcome the coupling of the magnetic latch. Thereafter, a replacement indicator ring may be slid over the knob and coupled thereto via the magnets. In some embodiments, the magnetic latch may eliminate the need of having separate engagement surfaces on the indicator ring and the knob, respectively, since the magnetic latch both retains and fixes the indicator ring onto the knob to promote rotation of the indicator ring with the knob when the knob is rotated.

In other embodiments, the latch may include a different mechanical fitting, such as a bayonet-type mount. For instance, the knob may include a number of tabs spaced around its body and the indicator ring may include a number of matching recesses sized to engage the tabs. Once the indicator ring is inserted over the knob, it may be twisted or turned a small amount to properly align the tabs and recesses to lock the indicator ring onto the knob.

In still other embodiments, the latch may include a spring-actuated system with one or more arms that may each extend radially outward from the knob. The arms may be linked to a mechanism (such as a lever or a button) carried by the knob, where actuation of the mechanism controls the movement of the arms to the locked and unlocked positions. For instance, in some embodiments, when the mechanism is manually actuated (e.g., depressed inwardly into the knob, pulled outwardly away from the knob, turned or rotated, etc.), the linked arms retract or are urged inwardly into the knob, thereby freeing the indicator ring and allowing it to be slid along the axis and off of the knob in a similar fashion as previously described.

In still other embodiments, the latch may incorporate other fittings or coupling systems, such as catches, bails, or rotating keepers for releasably retaining the indicator ring on the knob.

In some embodiments, buttons **135**, **140** may form a secondary retention structure to retain indicator ring **160** around a central portion **230** of knob **115** after indicator ring **160** has been dislodged from receiving surface **150** during the removal and replacement process (see FIGS. **5-6**). In one embodiment, actuatable buttons **135**, **140** may have a larger circumference than inner circumference **195** of indicator ring **160** such that indicator ring **160** cannot (or does not) easily slide by actuatable buttons **135**, **140** without an additional exertion of force by the shooter. In some embodiments, the user may simply apply additional pull force to slide indicator ring **160** past actuatable buttons **135**, **140**. In other embodiments, the shooter may first depress actuatable buttons **135**, **140** inwardly (as previously described), thereby providing sufficient clearance to easily remove indicator ring **160**.

Such configuration may be useful in providing a convenient holding place for indicator ring **160** while the shooter locates a replacement indicator ring. It may also provide a region to temporarily support indicator ring **160** and allow indicator ring **160** to rotate freely in relation to knob **115** so that the shooter can align a zero position of scale **165** with index mark **170** to calibrate riflescope **50**. Once zeroed, the

shooter may thereafter push indicator ring **160** downwardly past pins **205** and around lower base portion **130** to lock indicator ring **160** in position.

It will be obvious to those having skill in the art that many changes may be made to the details of the above-described embodiments without departing from the underlying principles of the invention. The scope of the present invention should, therefore, be determined only by the following claims.

The invention claimed is:

1. An adjustment device for a riflescope or other aiming device, comprising:

a knob mountable on the aiming device for rotation about an axis to drive an adjustment member of the aiming device;

a removable indicator ring slidable onto the knob along the axis for mounting thereon, wherein the indicator ring is keyed to the knob for rotation therewith, the indicator ring further including a contact surface; and

a first retention pin carried in a first bore of the knob and extending radially outward therefrom, the retention pin visible on a surface of the knob and extending over the contact surface, wherein the retention pin interferes with the contact surface of the indicator ring to retain the indicator ring on the knob when the retention pin is in a latched position, and wherein the retention pin is manually actuatable to retract at least a portion of the retention pin into the first bore to an unlatched position to allow the indicator ring to be moved along the axis and off of the knob.

2. The adjustment device of claim **1**, further comprising a second retention pin carried by the knob and extending radially outwardly therefrom, the second retention pin visible on the surface of the knob and extending over the contact surface, wherein the second retention pin interferes with the contact surface of the removable indicator to retain the indicator ring on the knob when the second retention pin is in the latched position, and wherein the second retention pin is manually actuatable to the unlatched position to allow the indicator ring to be moved along the axis and off of the knob.

3. The adjustment device of claim **2**, wherein the knob further includes a second bore carrying the second retention pin, the adjustment device further comprising:

a first biasing element arranged within the first bore to urge the first retention pin to extend radially outward from the first bore; and

a second biasing element arranged within the second bore to urge the second retention pin to extend radially outward from the second bore.

4. The adjustment device of claim **3**, wherein the first and second retention pins are each manually depressible, and wherein the first and second retention pins retract inwardly into the first and second bores, respectively, when manually depressed.

5. The adjustment device of claim **1**, wherein the indicator ring further includes indicia spaced apart and around the circumference of the indicator ring to facilitate fine adjustments for a shooting condition.

6. The adjustment device of claim **1**, wherein the contact surface includes a lip protruding inwardly from an inner surface of the indicator ring toward the knob.

7. The adjustment device of claim **1**, the knob further including a pair of buttons spaced apart from one another, wherein the buttons are biased to automatically lock the knob.

8. The adjustment device of claim **7**, wherein the buttons interfere with the indicator ring to retain the indicator ring on the knob when the retention pin is in an unlatched position and at least a portion of the indicator ring is positioned between the buttons and the retention pin.

9. The adjustment device of claim **8**, wherein the buttons are manually actuatable to unlock and allow rotation of the knob and to provide clearance for removing the indicator ring along the axis and off of the knob.

10. The adjustment device of claim **8**, wherein the indicator ring is free to rotate when at least a portion of the indicator ring is positioned between the buttons and the retention pin.

11. An adjustment device for a riflescope or other aiming device, comprising:

a knob mountable on the aiming device for rotation about an axis to drive an adjustment member of the aiming device;

a removable indicator ring slidable onto the knob along the axis for mounting thereon, wherein the indicator ring is keyed to the knob for rotation therewith, the indicator ring further including a lip protruding inwardly from an inner surface of the indicator ring toward the knob; and

a retention pin carried by the knob and extending radially outward therefrom, the retention pin visible on a surface of the knob and extending over the lip of the indicator ring, wherein the retention pin interferes with the lip of the indicator ring to retain the indicator ring on the knob when the retention pin is in a latched position, and wherein the retention pin is manually actuatable to an unlatched position to allow the indicator ring to be moved along the axis and off of the knob.

12. The adjustment device of claim **11**, wherein the lip is formed as an integral structure of the indicator ring.

13. The adjustment device of claim **11**, further including a gap separating the retention pin and the lip.

14. The adjustment device of claim **11**, wherein the indicator ring further includes indicia spaced apart and around a circumference of the indicator ring to facilitate fine adjustments for a shooting condition.

15. The adjustment device of claim **11**, wherein the knob further includes a bore carrying the retention pin, the adjustment device further comprising a biasing element arranged to urge the retention pin to extend radially outward from the first bore toward the indicator ring.

16. The adjustment device of claim **15**, wherein the retention pin is manually depressible to retract at least a portion of the retention pin inwardly into the bore.

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